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Professor Zvi Galil

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# PREFACE

## Festschrift for Zvi Galil

Zvi Galil celebrated his 50th birthday on June 26, 1997, and the *Journal of Complexity* is devoting a special issue to him. This Festschrift contains articles that were submitted on the day of his 50th birthday and that come from some of the research areas to which he has contributed. All the papers that appear in this volume were selected and refereed according to journal standards. We are grateful to Joe Traub, the Editor-in-Chief of the *Journal of Complexity*, for his support in making this volume possible, to all the colleagues who submitted their manuscripts, and to the anonymous referees who helped us in evaluating the submissions.

We begin with a few words about Zvi Galil's achievements. Zvi was born in Tel-Aviv, Israel on June 26, 1947. He received his B.S. and M.S. in Applied Mathematics from Tel-Aviv University in 1970 and 1971, respectively. He entered Cornell University in 1972 and received his Ph.D. in Computer Science in 1975. He next held research positions at the IBM Research Center (Yorktown Heights and San Jose).

In 1976, Zvi joined the Computer Science Department of Tel-Aviv University, where he was Chairman from 1979 to 1982, and where he became full professor in 1981. He also became a father. In 1982 he joined Columbia University as a Professor in the Department of Computer Science. This is where we met him, as graduate students eagerly willing to work with him on algorithms. He became the *Julian Clarence Levi Professor of Mathematical Methods and Computer Science* in 1987 and Chairman of the Computer Science Department in 1989. Luckily, we graduated before Zvi's administrative commitments increased substantially: in 1995 he became the *Dean of the School of Engineering and Applied Science* at Columbia University. He became *Morris and Alma A. Schapiro Professor of Engineering*. He was also elected *ACM Fellow* in 1995. His son Yair entered Columbia University and received his B.S. when he was only 18 years old. Yair was selected the class *salutatorian* of Columbia College (Class of 1996). He is perhaps the achievement of which Zvi is most proud.



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During these years Zvi has worked in so many areas that our brief description here cannot do justice to his many research contributions. Starting with his Ph.D. Thesis, he worked in *computational complexity*. Zvi's approach to solving problems in this area was bottom up, and he solved open problems such as: Is an exponential number of states really needed to simulate a two-way nondeterministic finite automaton by a deterministic one? What is the minimum parallel time required to solve some specific problems using a given number of processors? These problems got him interested in proving lower bounds, and in further investigating the *design and analysis of computer algorithms* and data structures.

He designed many new sequential and parallel algorithms and improved previous ones, solving various computational problems such as graph isomorphism, membership in permutation groups (generalized Rubik's Cube), network flows, matchings, Boolean matrix multiplication, string matching, and graph connectivity. His contributions to these areas have been most influential. In the last years, he has been concentrating in two particular algorithmic areas. The first is string processing with applications to molecular biology. These are computational problems associated with the human genome project where algorithmic improvements are possible. In particular, he achieved considerable progress in speeding up various dynamic programming techniques. The second algorithmic area concerns dynamic graph algorithms. These are algorithms which solve problems in which the input graph keeps changing; e.g., edges are inserted and deleted or weights are increased or decreased. The goal is to maintain the solution in such a way that the changes can be found faster than resolving the problem from scratch.

Finally, Zvi became interested in *cryptography and security*. There are several number-theoretic problems, such as factoring of integers, primality testing, discrete logarithms, and quadratic residuosity, which are used as the basis for public key cryptosystems. The security of such cryptosystems critically depends on the complexity of these problems. Zvi worked in gaining a deeper understanding of the complexity of these problems, which helped reasoning about the security of cryptosystems. Proving the correctness and security of cryptosystems is typically hard. Zvi met this challenge by finding general techniques that could be proven correct once and then applied in many ways to form different protocols.

Zvi's commitment to research is witnessed by the fact that he has authored or coauthored over 120 journal papers and over 70 papers in conference proceedings. He has been a frequent traveler and gave over 150 invited talks in more than 20 countries. He founded and organized the successful series of Columbia University Theory Days, and he has been, or still is, Editor-in-Chief, Managing Editor, Area Editor, and Member of the Editorial Board of many computer science journals, including *J. ACM*,

*SIAM J. Comput.*, *J. Algorithms*, and *Mathematical Systems Theory*. Organizing a Festschrift behind his back has been extremely difficult.

Zvi advised more than 15 Ph.D. students, and for most of us he was not only an advisor but also a very close personal friend. We can witness that being a student of his was really an intellectual challenge and are very grateful to him for all his help and guidance throughout our graduate studies. Working with him was real fun, and we could not have wished ourselves a better advisor. The only question which still puzzles us is how he finds the time to manage all this.

On this occasion, we thank Zvi for what he has taught us throughout these years. Although we are no longer his students and are getting older, we are happy to see that Zvi's deep scientific curiosity and his continuous desire to tackle new challenges are keeping him very young and vigorous.

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